NYU MERIIT Lab Seminar Series

Data-Driven Control under Input and Measurement Noise

Time: 12pm on Feb 21, 2023
Location: 370 Jay, 8th floor, Room 825
Zoom: https://nyu.zoom.us/j/97493268038

Name: Jared Miller (https://jarmill.github.io/)

Affiliation: Robust Systems Lab, Northeastern University, Boston, MA

Abstract: Data-Driven Control (DDC) is a methodology that formulates controllers directly from observations without requiring a system identification step. DDC under process noise can be achieved in polynomial time (under assumptions on noise structure) through methods such as Subspace Methods, Willem's Fundamental Lemma, Superstability, and Quadratic Matrix Inequalities. The introduction of input and measurement noise is called the Error-in-Variables (EIV) setting, and adds a bilinearity that results in NP-hard system identification and control problems. This work presents a polynomial-optimization based framework to perform stabilizing and robust control of all consistent plants in the EIV setting when all noise processes are L_∞ norm bounded. The moment-Sum-of-Squares (SOS) hierarchy is used to find a superstabilizing or quadratically stabilizing common controller, where each nonnegativity constraint is posed over the set of unknown plants and unknown noise processes. A theorem of alternatives is used to eliminate the unknown noise variables and improve computational scalability. This SOS-based framework may be extended towards the control of autoregressive models with input-output data.

Joint work with: Tianyu Dai (Mathworks), Mario Sznaier (Northeastern University)

Bio: Jared Miller is a 5th year PhD Student at the Robust Systems Lab at Northeastern University, advised by Mario Sznaier. He received his B.S. and M.S. degrees in Electrical Engineering from Northeastern University in 2018. He is a recipient of the 2020 Chateaubriand Fellowship from the Office for Science Technology of the Embassy of France in the United States. He was given an Outstanding Student Paper award at the IEEE Conference on Decision and Control in 2021 and in 2022. His current research topics include safety verification and data-driven control. His interests include large-scale convex optimization, semi-algebraic geometry, measure theory, and analysis of nonlinear systems.

Relevant papers:
https://ieeexplore.ieee.org/abstract/document/9992363
https://arxiv.org/abs/2210.14893, https://arxiv.org/abs/2210.14893